M.H

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Assistant Commissioner for Patents
United States Patent and Trademark Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 08 February 2000 (08.02.00)	
International application No. PCT/SE99/01024	**Applicant's or agent's file reference** P09410WO
International filing date (day/month/year) 10 June 1999 (10.06.99)	**Priority date** (day/month/year) 18 June 1998 (18.06.98)
Applicant JÄNDEL, Magnus et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

20 December 1999 (20.12.99)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer R. E. Stoffel
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

Form PCT/IB/331 (July 1992)

3094633

15

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P09410	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/SE99/01024	International filing date *(day month year)* 10.06.1999	Priority date *(day month year)* 18.06.1998
International Patent Classification (IPC) or national classification and IPC7 H04N 7/26, G06T 9/00		
Applicant Telefonaktiebolaget LM Ericsson (publ) et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 8 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20.12.1999	19.10.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Telex 17978 PATOREG-S Facsimile No. 08-667 72 88	Authorized officer Jan Silfverling/LR Telephone No. 08-782 25 00

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/SE99/01024

I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☐ the international application as originally filed.

☒ the description, pages 1-16 , as originally filed,
pages _____ , filed with the demand,
pages _____ , filed with the letter of _____ ,
pages _____ , filed with the letter of _____ .

☒ the claims, Nos. _____ , as originally filed,
Nos. 1-18 , as amended under Article 19,
Nos. _____ , filed with the demand,
Nos. _____ , filed with the letter of _____ ,
Nos. _____ , filed with the letter of _____ .

☒ the drawings, ~~sheets~~/fig 1-7 , as originally filed,
~~sheets~~/fig _____ , filed with the demand
~~sheets~~/fig _____ , filed with the letter of _____ ,
~~sheets~~/fig _____ , filed with the letter of _____ .

2. The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, ~~sheets~~/fig _____

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

V. Resoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-18	YES
	Claims		NO
Inventive step (IS)	Claims	1-18	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-18	YES
	Claims		NO

2. Citations and explanations

This statement is based on the amended claims filed with the letter of 9 November 1999.

The present invention relates to a method and an arrangement of transmitting an image between a transmitter and a receiver, comprising the steps of:
- dividing the image into at least two image regions;
- coding the image regions into a coded symbol stream, said coding utilising a symbolic representation and having predetermined accuracy levels in said image region and
- compressing the coded symbol stream into a compressed bit stream.

The method and device includes the further steps of:
- generating a definition of an outer boundary line/a mask of/for at least one of the image regions
- transmitting the compressed bit stream to the receiver; and
- decoding in the receiver with the aid of said definition.

In the International Search Report, the following documents were cited:

D1: US 575 79 74 A
D2: " Progressive ROI Coding and Siagnostic Quality for medical Image Compression" A. Sigoroni et.al Visual communications and Image Processing'98, Proceedings of the SPIE, Volume 3309, p. 674 - 685

.../...

Supplemental Box
(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V

D1 discloses a data compression system including an image pre-processor for generating a digitised, formatted set of pixels which is passed to an image transformer. The image transformer generates a set of wavelet coefficients from the formatted set of pixels via a series of one-dimensional wavelet transforms. A compression processor selects a subset of the wavelet coefficients for retention based on areas of interest in the original image and the position of coefficients within the set of coefficients. The compression processor then builds a compressed image file using a coefficient location identifier to reduce the size of the addresses that indicate the position of the selected coefficients within the set.

The present claimed invention, as recited in independent claim 1, is distinguishable from D1. A region of interest ROI in D1 is defined by its coefficients being multiplied by a factor and then compared with the threshold value. In the invention on the contrary the region of interest ROI is defined explicitly by a mask, claims 3 and 12, or by a contrary line, claims 1 and 10. In D1, the ROI are dependent of each other in that a big coefficient in a lower weighted region can be regarded as a small coefficient in a higher weighted region. In the invention on the other hand, the regions have levels of accuracy independently of each other.

For the above reason, D1 does not anticipate the present claimed invention and thus the invention according to claims 1,3, 10 and 12 is novel and is considered to involve an inventive step and have industrial applicability, according to Article 33.2 and Rule 64 PCT. The same applies for the dependent claims 2, 4 - 9, 11, 13 - 18, as all refer to claims 1, 3, 10 or 12.

The cited document D2 shows the state of the art.

11 -02- 2000

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING AMENDMENTS OF THE CLAIMS

(PCT Rule 62 and Administrative Instructions, Section 417)

To:

Swedish Patent Office
P.O. Box 5055
S-102 42 Stockholm
SUÈDE

in its capacity as International Preliminary Examining Authority

Date of mailing (day/month/year)	
08 February 2000 (08.02.00)	
International application No.	**International filing date (day/month/year)**
PCT/SE99/01024	10 June 1999 (10.06.99)

Applicant

TELEFONAKTIEBOLAGET LM ERICSSON (publ) et al

The International Bureau hereby transmits a copy of the amendments to the claims under Article 19 together with any accompanying statement (Rule 62).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 740.14.35

Authorized officer

R. E. Stoffel

Telephone No. (41-22) 338.83.38

ERICSSON

Vår handläggare namn, tfn - *Attending to this matter name, telephone*
HF/ETX/MI Martin Kristofersson +46 8 719 2992

Datum - *Date*
1999-11-03
Ert datum - *Your date*
1999-10-16

Benämning - *Reference*
P09410WO
Er beteckning - *Your reference*
PCT/SE99/01024

The International Bureau of WIPO
34, Chemin des Colombettes
CH-1211 Geneva 20
SWITZERLAND

REC'D 09 NOV 1999
WIPO PCT

International Patent Application No. PCT/SE99/01024

Enclosure(s)

1. Claims 1-18

We have received the international search report in the entitled application with a communication of 16. October 1999. In this connection we wish to file a set of amended claims 1-18, which is enclosed to this letter.
Earlier claim sheets 17 and 18 of the application as filed are to be replaced by these enclosed claim sheets 1-5.

Statement under Article 19(1)

In the amended independent method claim 1, which in the main corresponds to earlier claim 1, a feature defining an outer boundary line is inserted. This is supported by the description page 9, lines 22,23. Dependent claim 2 defines that different regions are coded independently, supported by the description page 7, lines 12-14. The new independent method claim 3, also in the main corresponding to earlier claim 1, defines a mask for the image regions and that the image regions are coded independently of each other. Support in the description is to be found at page 3, lines 14-19; page 6, line 29 to page7, line 10; page 7, lines 12-14.

The scope of earlier claim 1 has been broadend in one respect. The feature of decoding predetermined parts of the bit stream has been removed from claim 1 and is instead defined in the new dependent claim 4.

The new independent method claims 5-9 define a number of descriptions and an associated pointer for the transmitted image. Support is in the description at page 8, line 20 to page 10, line 14.

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IPR Management and Patent Department

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Momsnr - *V.A.T. No.*: SE556251325801
Organisationsnr - *Reg. No.*: 556251-3258

Telefax - *Telefax*
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Vår handläggare namn, tfn - *Attending to this matter name, telephone*
HF/ETX/MI Martin Kristofersson +46 8 719 2992

Datum - *Date*
1999-11-03
Ert datum - *Your date*
1999-10-16

Benämning - *Reference*
P09410WO
Er beteckning - *Your reference*
PCT/SE99/01024

The earlier independent device claim 2 is amended in a corresponding way as claim 1 and is now claim 10. The new device claim 12 corresponds to the new method claim 3. The new independent device claims 11 and 13-18 correspond to the respective claims 2 and 4-9.

ERICSSON TELECOM AB
IPR Management and Patent Department

Martin Kristofersson

Ericsson Telecom AB
IPR Management and Patent Department

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REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For Receiving Office use only

International Application No. PCT/SE 99/01024

International Filing Date 10-06-1999

Name of receiving Office and "PCT International Application" The Swedish Patent Office PCT International Application

Applicant's or agent's file reference *(if desired) (12 characters maximum)* P09410WO

Box No. I TITLE OF INVENTION

Method and apparatus in transmission of images

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Telefonaktiebolaget L M Ericsson (publ)
SE-126 25 STOCKHOLM
SWEDEN

☐ This person is also inventor.

Telephone No. +46 8 719 0000

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Teleprinter No.

State *(that is, country)* of nationality: SWEDEN

State *(that is, country)* of residence: SWEDEN

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Jändel, Magnus
Vårvägen 10
SE-194 60 UPPLANDS VÄSBY
SWEDEN

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is,country)* of nationality: SWEDEN

State *(that is, country)* of residence: SWEDEN

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is ~~hereby~~/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☒ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

Ericsson Telecom AB
IPR Management & Patent Department
SE-126 25 STOCKHOLM
SWEDEN

Telephone No. +46 8 719 0000

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Teleprinter No.

☐ **Adress for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

PCT/SE 99/01024
10 -06- 1999

Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTORS

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Larsson, Mathias
Katarinavägen 18
SE-116 45 STOCKHOLM
SWEDEN

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: SWEDEN

State *(that is, country)* of residence: SWEDEN

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Christopoulos, Charilaos
Lomvägen 641, II
SE-192 57 SOLLENTUNA
SWEDEN

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: GREECE

State *(that is, country)* of residence: SWEDEN

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☒ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☐ the United States of America only
- ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of:
- ☐ all designated States
- ☐ all designated States except the United States of America
- ☐ the United States of America only
- ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ☒ **AP** **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA** **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA** **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ☒ **AL** Albania .....
- ☒ **AM** Armenia .....
- ☒ **AT** Austria .....
- ☒ **AU** Australia .....
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- ☒ **IL** Israel .....
- ☒ **IN** India .....
- ☒ **IS** Iceland
- ☒ **JP** Japan .....
- ☒ **KE** Kenya .....
- ☒ **KG** Kyrgyzstan .....
- ☒ **KP** Democratic People's Republic of Korea .....
- ☒ **KR** Republic of Korea .....
- ☒ **KZ** Kazakhstan .....
- ☒ **LC** Saint Lucia
- ☒ **LK** Sri Lanka
- ☒ **LR** Liberia
- ☒ **LS** Lesotho .....
- ☒ **LT** Lithuania
- ☒ **LU** Luxembourg
- ☒ **LV** Latvia
- ☒ **MD** Republic of Moldova .....
- ☒ **MG** Madagascar .....
- ☒ **MK** The former Yugoslav Republic of Macedonia .....
- ☒ **MN** Mongolia
- ☒ **MW** Malawi .....
- ☒ **MX** Mexico .....
- ☒ **NO** Norway
- ☒ **NZ** New Zealand .....
- ☒ **PL** Poland .....
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- ☒ **SE** Sweden
- ☒ **SG** Singapore
- ☒ **SI** Slovenia .....
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- ☒ **SL** Sierra Leone
- ☒ **TJ** Tajikistan .....
- ☒ **TM** Turkmenistan .....
- ☒ **TR** Turkey .....
- ☒ **TT** Trinidad and Tobago .....
- ☒ **UA** Ukraine .....
- ☒ **UG** Uganda .....
- ☒ **US** United States of America .....
- ☒ **UZ** Uzbekistan .....
- ☒ **VN** Viet Nam .....
- ☒ **YU** Yugoslavia .....
- ☒ **ZW** Zimbabwe .....

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☒ AE United Arab Emirates .....
- ☒ ZA South Africa .....
- ☐ .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)*

PCT/SE 99/01024
10 -06- 1999

Box No. VI PRIORITY CLA ☐ Further priority [illegible]ns are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 18/06/1998	9802193-4	SE		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): 1

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*

ISA / SE

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date (day/month/year)	Number	Country (or regional Office)
18/06/1998	SE 98/00637	SE

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets**:

request	: 4
description (excluding sequence listing part)	: 14
claims	: 2
abstract	: 1
drawings	: 5
sequence listing part of description	:
Total number of sheets	: 26

This international application is **accompanied by** the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: ITS-report No. SE 98/00637

Figure of the drawings which should accompany the abstract: 2

Language of filing of the international application: Swedish

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

Ericsson Telecom AB
IPR Management & Patent Department

Lena Svensson

Lena Svensson
Agent

For receiving Office use only

1. Date of actual receipt of the purported international application: 10 -06- 1999	2. Drawings: ☒ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA / SE	6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau: 03 AUGUST 1999 (03.08.99)

See Notes to the request form

PCT/SE 99/01024

27 -08- 1999

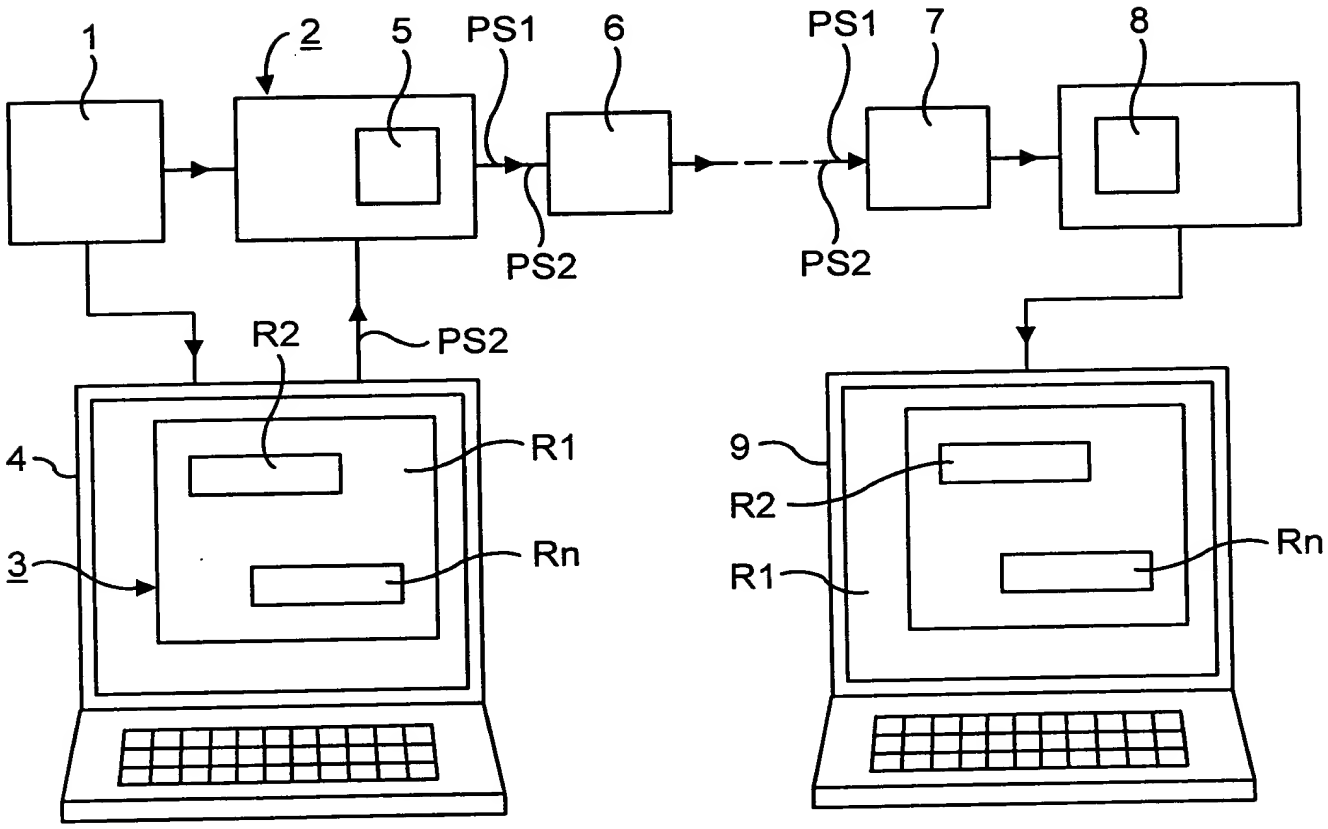

Fig. 1

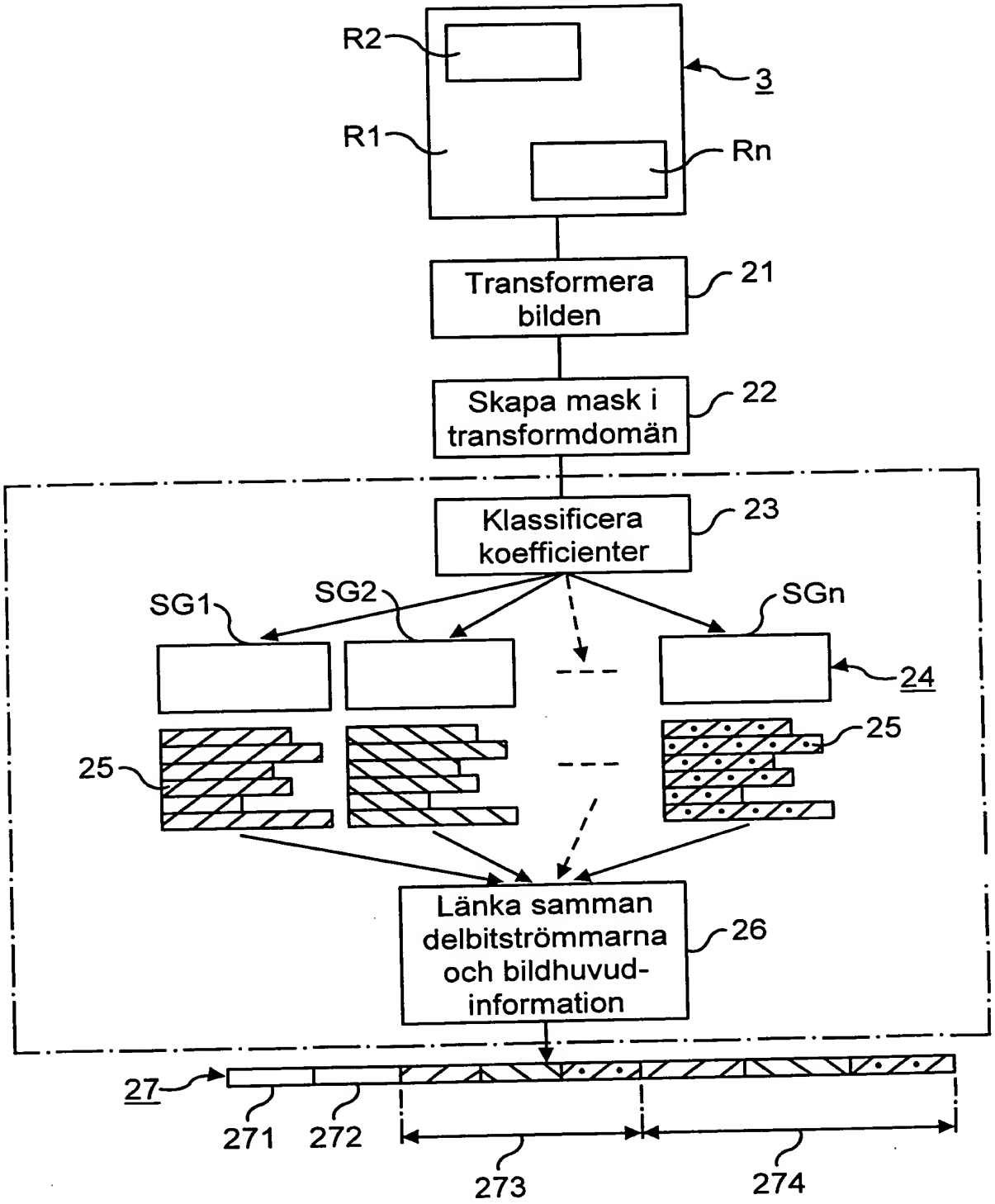
R2
3
R1
Rn
Transformera bilden
21
Skapa mask i transformdomän
22
Klassificera koefficienter
23
SG1
SG2
SGn
24
25
25
Länka samman delbitströmmarna och bildhuvud-information
26
27
271
272
273
274

Fig. 2

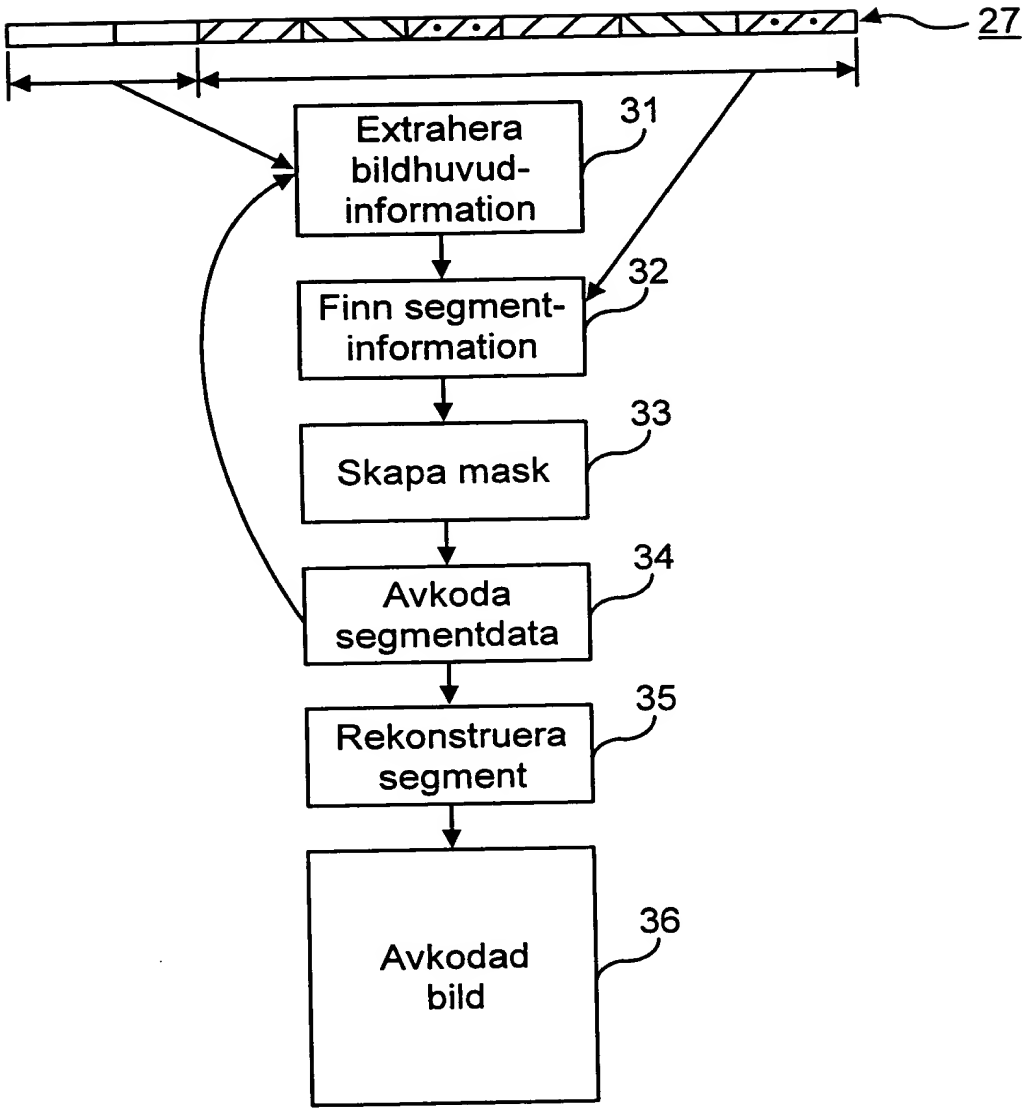
27
Extrahera bildhuvud-information
31
Finn segment-information
32
Skapa mask
33
Avkoda segmentdata
34
Rekonstruera segment
35
Avkodad bild
36

Fig. 3

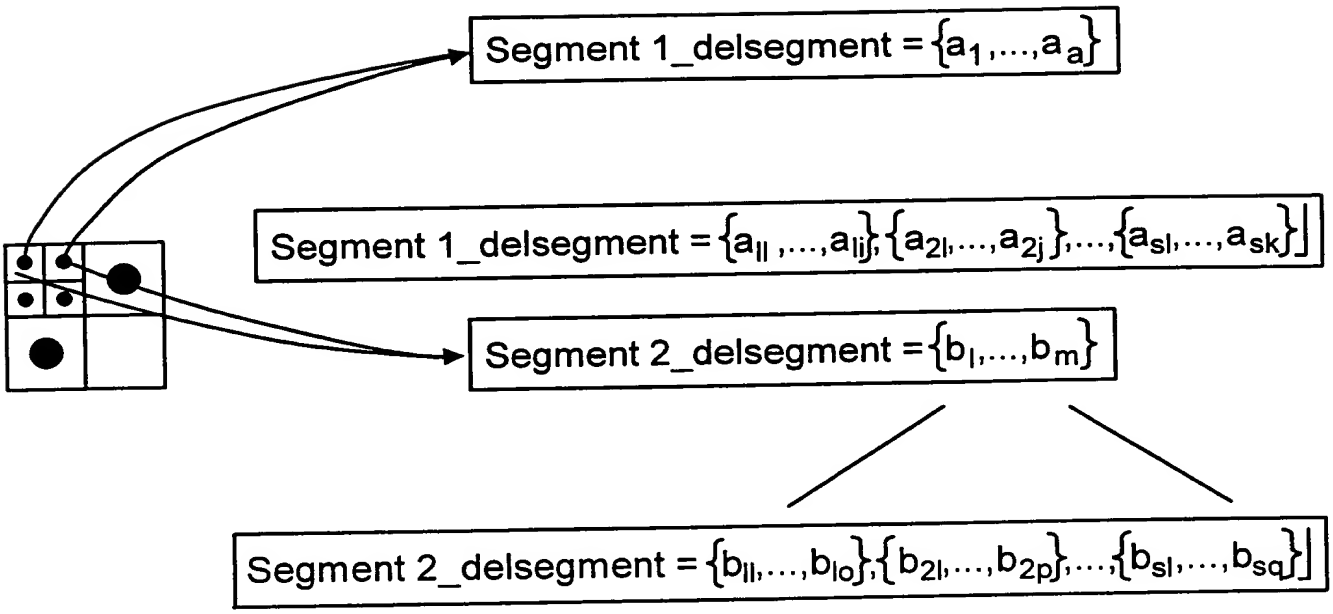
Segment 1_delsegment = {a1,...,aa}
Segment 1_delsegment = {all,...,aij},{a2l,...,a2j},...,{asl,...,ask}
Segment 2_delsegment = {bl,...,bm}
Segment 2_delsegment = {bll,...,blo},{b2l,...,b2p},...,{bsl,...,bsq}

Fig. 4

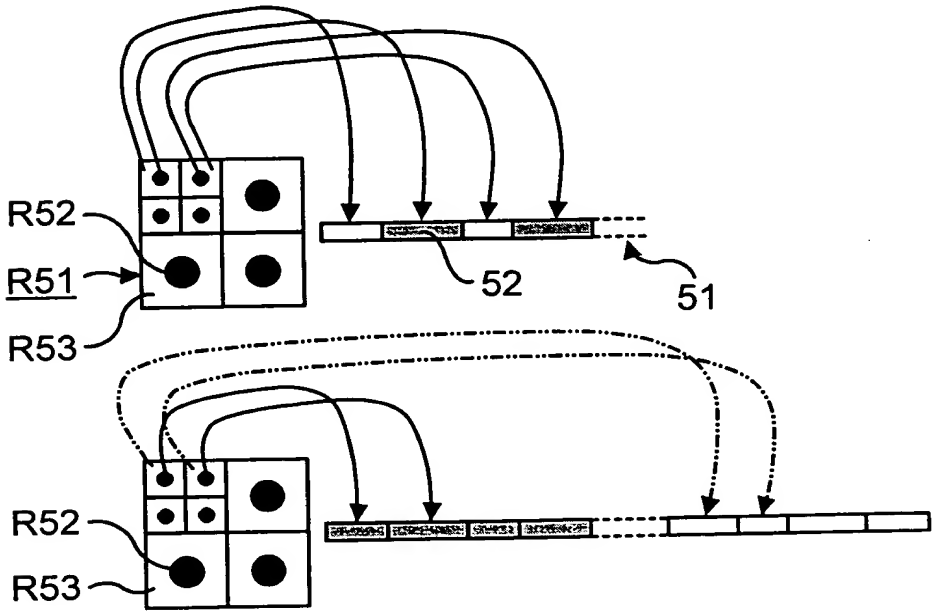
R52
R51
R53
52
51
R52
R53

Fig. 5

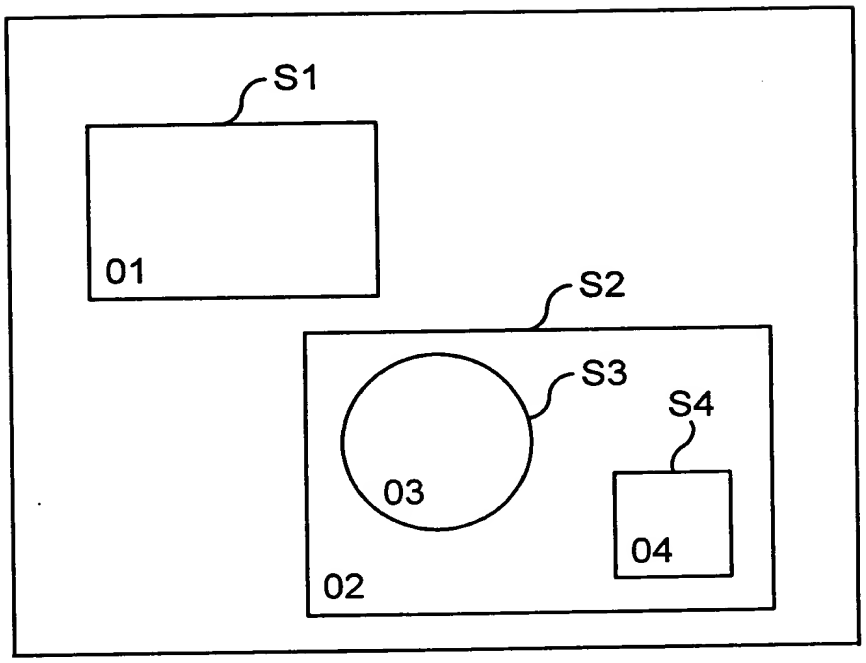

Fig. 6

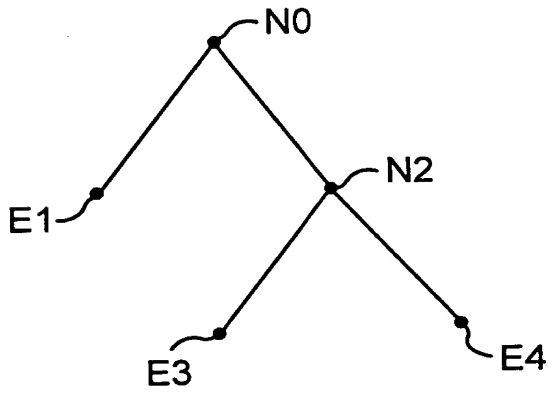

Fig. 7

FÖRFARANDE OCH ANORDNING VID ÖVERFÖRANDE AV BILDER

TEKNISKT OMRÅDE

Föreliggande uppfinning hänför sig till ett förfarande och en anordning för att koda och extrahera intresseregionerna (Regions Of Interest, ROI) vid överföring av stillbilder och video. Förfarandet och anordningen är särskilt lämpade för kodare som baseras på en transform av bilden såsom wavelet- och DCT-transform.

TEKNIKENS STÅNDPUNKT

Vid överföring av stillbilder från en sändare till en mottagare är bilden vanligen kodad för att minska den mängd bitar som fordras för att överföra bilden.

Skälet till att minska bitmängden är vanligen att kapaciteten hos den utnyttjade kanalen är begränsad. En digitaliserad bild består emellertid av ett mycket stort antal bitar. När en sådan bild bestående av ett mycket stort antal bitar överföres över en kanal som har begränsad bandbredd blir överföringstiden vid de flesta tillämpningar oacceptabelt lång om varje bit i bilden måste överföras.

Därför har stora forskningsansträngningar under senare år rört kodningsmetoder och teknik för digitaliserade bilder som syftar till att reducera det antal bitar som är nödvändigt för att överföra bilderna.

Metoderna kan delas upp i två grupper:

Förlustfria metoder, d.v.s. metoder som utnyttjar redundans i bilden på sådant sätt att bilden kan rekonstrueras av mottagaren utan någon förlust av information.

Förlustgivande metoder , d.v.s. metoder som utnyttjar det faktum att alla bitar inte är lika viktiga för mottagaren. Därför är den mottagna bilden inte identisk med originalet,

men är för exempelvis det mänskliga ögat tillräckligt lik originalbilden.

Vid en del tillämpningar är vissa delar av den överförda bilden mer intressant än resten av bilden och det är därför önskvärt med en bättre visuell kvalitet hos dessa delar av bilden. En sådan del benämnes vanligen "intresseregion" (ROI). Tillämpningar i vilka detta kan vara användbart är exempelvis medicinska databaser eller överföring av satellitbilder. I vissa fall är det önskvärt eller nödvändigt att intresseregionen överföres förlustfritt, medan kvalitén hos resten av bilden är av mindre intresse. Det finns också tillfällen då det fordras att intresseregionerna extraheras från bitströmmen och avkodas utan att hela bilden måste avkodas.

I de båda svenska patentansökningarna SE 9703690-9 och SE 9800088-8 anges hur en mask kan beräknas för att avgränsa en sådan intresseregion (ROI).

REDOGÖRELSE FÖR UPPFINNINGEN

Föreliggande uppfinning angriper det ovannämnda problemet att vid bildöverföring ange och överföra intresseregioner och bakgrundsregion i bilderna med olika kvalité på de olika regionerna.

Den grundläggande idén till problemets lösning är, att transformera bilden och att definiera en mask i denna transform som svarar mot intresseregionerna och bakgrund. Regiondefinitionen och transformationen av bilden överföres till en mottagare, vilken kan återskapa bilden med den önskade kvalitén i de förutbestämda regionerna.

Något mera detaljerat innefattar problemlösningen att bilden delas upp i de önskade regionerna. Bilden transformeras

därefter till någon typ av transformkoefficienter. En mask svarande mot de skilda regionerna i bilden definieras i transformdomänen och koefficienterna klassificeras och hänföres enligt maskdefinitionen till skilda segment. Dessa segment hör alltså till de motsvarande regionerna i bilden. Segmenten och koefficienterna överföres i komprimerad form till en mottagare som kan återskapa dels bildens regioner, dels själva bilden med den önskade bildkvalitén i de olika regionerna.

Uppfinningen har fördelen att flera olika intresseregioner kan definieras.

En annan fördel är att de olika regionerna kan ha flera olika grader av bildkvalité.

Ännu en fördel är att endast de delar av bilden som är av vitalt intresse för användaren behöver avkodas, medan man kan undvika att avkoda hela bilden.

Ytterligare en fördel är att segmenten kan kodas oberoende av varandra.

Uppfinningen kommer nu att beskrivas närmare med hjälp av föredragna utföringsformer och med hänvisning till bifogade figurer.

FIGURBESKRIVNING

Figur 1 visar ett blockschema över en uppfinningsenlig anordning;

Figur 2 visar med ett flödesdigram en del av ett uppfinningsenligt förfarande;

Figur 3 visar med ett flödesdiagram ytterligare en del av ett uppfinningsenligt förfarande;

Figur 4 visar ett diagram för klassificering av transformkoefficienter;

Figur 5 visar diagram för sammanlänkning av bildsegment i en bitström;

Figur 6 visar en vy av en bild med objekt;och

Figur 7 visar ett diagram med grafisk representation av topologin i figur 6.

FÖREDRAGNA UTFÖRINGSFORMER

Figur 1 visar översiktligt en anordning för att koda och överföra bilder. En digital kamera 1 har en bild 3 av ett föremål lagrad i digital form och bilden presenteras på en skärm 4. Skärmen är ansluten till en dator 2 som har program för att dela upp bilden 3 i objekt eller regioner, av vilka en bakgrund R1 och intresseregioner R2 och Rn visas. En bildkodare 5 i datorn 2 wavelet-transformerar bilden, varvid samtidigt en bildkompression utföres, och genererar en komprimerad bitström PS1. En operatör vid bildskärmen 4 definierar intresseregionerna R2 och Rn. Bildkodaren har anordningar för att enligt regionerna skapa en mask PS2 och med hjälp av denna hänföra skilda delar, segment, av bitströmmen till de motsvarande av regionerna R1, R2 och Rn. Definitionen innefattar också att regionerna R1, R2, Rn i form av de skilda segmenten i bitströmmen PS1 kodas med olika grad av noggrannhet. En sändare 6 sänder bitströmmen inklusive definitionen av regionernas R2 och Rn positioner och form till en mottagare 7, som är ansluten till en dator med en bildavkodare 8. Denna avkodar bitströmmen PS1 och återskapar maskdefinitionen PS2 och presenterar bilden på en bildskärm 9. Bakgrunden R1 har här en relativt låg noggrannhet medan regionerna R2 och Rn har varsin högre noggrannhet.

Till hjälp att beskriva det uppfinningsenliga förfarandet skall följande definitioner göras:

- Ett segment definieras såsom alla de koefficienter i transformdomänen, som tillhör ett visst objekt eller bakgrunden i bilden. Segmenten kan sedan ytterligare delas upp i delsegment.

- Ett delsegment definieras här som ett antal koefficienter i en del av transformdomänen (exempelvis ett delband i fallet med wavelet-transformen) som fordras för rekonstruktionen och tillhör ett segment i den digitaliserade bilden, se figur 4.

Som nämnts ovan klassificeras koefficienterna och kan hänföras till skilda segment. När denna klassificering är gjord kodas segmenten oberoende av varandra till olika grader av exakthet, vilket ger en bitström för varje segment. Dessa segment sammanfogas sedan.

Det uppfinningsenliga förfarandet som utföres vid kodningen skall beskrivas i anslutning till figur 2. Den digitaliserade bilden 3 som skall överföras uppvisar bakgrunden R1 och intresseregionerna R2 och Rn. Följande steg utföres:

1. Utför en transformation av bilden 3 enligt steg 21. Denna transformation utföres enligt exemplet med en wavelet-transform eller DCT (Discrete Cosine Transform).

2. Med hjälp av informationen om hur den digitaliserade bilden 3 skall uppdelas i bakgrunden R1 och objekten R2 och Rn skapas en mask enligt steg 22. Härvid användes exempelvis den teknik som finns beskriven i de svenska patentansökningarna SE 9703690-9 och SE 9800088-8. Masken skapas i transformdomänen och anger vilka koefficienter som fordras för att rekonstruera de olika objekten eller

bakgrunden. Olika segment SG1, SG2 och SGn svarar mot bakgrunden R1 och objekten R2 och Rn.

3. Masken utnyttjas enligt steg 23 för att klassificera transformkoefficienterna så att de tillhör de olika segmenten SG1, SG2, SGn.

4. Koda segmenten oberoende av varandra enligt steg 24. Detta ger det antal bitar som fordras för varje delsegment, d.v.s. en uppsättning delbitströmmar 25, en för varje delsegment.

5. Länka samman delbitströmmarna enligt steg 26 tillsammans med nödvändig bitströmsinformation och bildhuvud-information. Detta fordrar en bitströmsbeskrivning som följer nedan.

6. Sänd den sammanlänkade bitströmmen 27. Denna innefattar forminformation 271, bitströmsinformation 272, delband 0 betecknat 273 och delband 1 betecknat 274.

Metoden gör det möjligt för mottagaren att ha omedelbar tillgång till godtyckliga delar i bilden där så fordras, såsom visas i figur 3. Detta är möjligt eftersom informationen om var i bitströmmen de olika delarna finns är känd.

I anslutning till figur 3 beskrivs nedan ett sätt för avkodaren att arbeta:

1. Mottag bitströmmen 27 och avkoda den erforderliga informationen i bildhuvudet enligt steg 31.

2. Finn och avkoda den erforderliga segmentinformationen, steg 32.

3. Skapa en mask i transformdomänen genom att använda exempelvis den teknik som beskrivs i de nämnda

patentansökningarna SE 9703690-9 och SE 9800088-8, steg 33. Masken beskriver vilka koefficienter som fordras för att rekonstruera de önskade objekten eller bakgrunden.

4. Avkoda erforderligt segmentdata från bitströmmen, steg 34.

5. Rekonstruera de erforderliga segmenten, steg 35.

6. Avkoda och visa bilden, steg 36.

BESKRIVNING AV BITSTRÖMMEN

Nedan skall beskrivas de komponenter i bitströmmen 27 som fordras vid användning av den beskrivna tekniken.

Datastruktur och pekare

Pekare

En pekare är en uppsättning symboler som definierar positionen av en bit eller en byte i en bitström eller en fil. Inom datorvetenskapen har många sätt att beskriva pekare definierats. Vilken som helst lämplig sådan metod kan användas här. En pekare kan definieras implicit genom en regel för sammansättning av en bitström. En pekare kan definieras relativt en explicit eller implicit bestämd position. Ett enkelt sätt att definiera en pekare är att bestämma antalet bitar mellan den begärda positionen och en känd referenspunkt såsom exempelvis den första biten i bitströmmen.

Topologibeskrivning

Topologibeskrivningen, TOP, är en uppsättning symboler som bestämmer det topologiska förhållandet mellan numrerade

objekt och former. Detta illustreras i figur 6, i vilken fyra objekt O1, O2, O3, O4 och fyra former S1, S2,S3 och S4 visas. Topologin i bilden kan exempelvis representeras genom en trädförgrening såsom visas i figur 7. Noderna och kanterna hos trädförgreningen kan kodas i en datastruktur med användande av välkända metoder. P_TOP är en pekare till en topologibeskrivning.

Formbeskrivning

En formbeskrivning, S_i , definierar utseendet för en sluten gränslinje hos ett objekt. Formnumret, i, anges av en topologibeskrivning. Många olika formkodningstekniker kan användas. Exempel på sådana metoder är kedjekodning och formkodningsmetoder i MPEG-4. Formbeskrivningar kan avkodas oberoende av varandra när väl deras respektive position i bitströmmen är känd. P_S_i är en pekare till en formbeskrivning.

Segmentbeskrivning

En segmentbeskrivning, T_i, är en komprimerad uppsättning symboler som kodar ett segment såsom beskrivits ovan. Segmentet innehåller en föreskriven uppsättning av delsegment. Ojektnumret, i, anges av en topologi-beskrivning. p_T_i är en pekare till en segmentbeskrivning.

Delsegmentbeskrivning

En delsegmentbeskrivning, B_{ij}, är ett självständigt avkodningsbart delsegment ,j, av en segmentbeskrivning, T_i, som beskriver exempelvis koefficienterna som tillhör ett

givet delband, j, såsom beskrivits ovan. p_B_{ij} är en pekare till en delsegmentbeskrivning.

Multiplexerad segmentbeskrivning

Ett flertal segmentbeskrivningar, {T_i, T_j, T_k ...}, kan multiplexeras till en gemensam datastruktur MT(i,j,k). Detta göres vanligen i avsikt att utföra samtidig progressiv överföring av en uppsättning av objekt. Datastrukturen, MT, kallas en multiplexerad segmentbeskrivning. Ett flertal multiplexeringsmetoder kan användas. p_MT är en pekare till en multiplexerad segmentbeskrivning.

Segmentmultiplexeringsmetoder

Exempel på multiplexeringsmetoder visas i figur 5. En enkel metod är att interfoliera delsegment 52 som hör till komponentsegmenten så att:

MT(i,j,k)={B_{i0}, B_{j0}, B_{k0}, B_{i1}, B_{j1}, B_{k1}, B_{i2}, B_{j2}, B_{k2}... }

Här motsvarar ordningen på symbolerna ordningen i bitströmmen 51 varvid symboler till vänster sändes först. Delsegment i en multiplexerad ström kan uteslutas om de är kända av avkodaren.

Format för lagring av bitströmmen

För att åstadkomma omedelbar tillgång till vilket godtyckligt objekt som helst i bilden bör den lagrade

bitströmmen eller filstrukturen innefatta åtminstone följande komponenter:

I bildhuvudet, om så erfordras:

Topologibeskrivning TOP

Pekare till formbeskrivning {p_S_1, p_S_2...p_S_N}

Pekare till segmentbeskrivning {p_T_0, p_T_1,...p_T_N}

Valfria pekare till delsegmentbeskrivning: för varje k=[0,N], {p_B_{k0}, p_B_{k1},...p_B_{kN} }

I själva den lagrade bitströmmen om så erfordras:

Formbeskrivning {S_1, S_2,...S_N}

Segmentbeskrivning {T_0, T_1,...T_N}

En grupp med element för segmentbeskrivning med index {k,l,m...}kan enligt val ersättas med multiplexerad segmentbeskrivning MT(k,l,m...)

N är antalet lagrade objekt . Bakgrunden är objektet med index 0.

PROGRESSIV ÖVERFÖRING MED OMEDELBAR TILLGÅNG TILL GODTYCKLIGT OBJEKT

En server mottar en förfrågan att sända bilddata till en klient. Bilden är lagrad i servern i det format som beskrivits i föregående avsnitt. En del av de lagrade datastrukturerna (topologisk information, former, segment och delsegment) kan redan ha sänts till mottagande terminal. Detta avsnitt beskriver en procedur för att sätta samman en bitström hos den server som behandlar den nämnda förfrågan.

Exempel

Förfrågan från brukare

En enkel förfrågan innehåller följande information:

Sänd objekt med numren k, l, m ... och med noggrannheten n_k, n_l, n_m respektive, varvid noggrannheten är indexet för det högsta delsegment som sändes för varje index.

Flera primitiva förfrågningar kan sändas. De kommer att betjänas i den ordning de mottages eller i en ordning som är föreskriven på annat sätt.

Förfarande för att betjäna en förfrågan (detaljer)

Sänd topologisk information om så erfordras. TOP sändes som svar på en första förfrågan om information rörande en bild.

Sänd alla formbeskrivningar som är nödvändiga för att beskriva gränslinjen för de efterfrågade objekten. Formbeskrivningar som redan är kända för avkodaren behöver inte sändas. Med användande av den topologiska trädförgreningen i figur 7 finner man att alla formbeskrivningar på samma gren som objektet på samma eller lägre hierarkisk nivå inte behöver sändas. Servern känner till avkodarens tillstånd och kommer bara att sända de formbeskrivningar som inte är kända av avkodaren.

Sänd (multiplexerade) delsegmentbeskrivningar som beskriver de efterfrågade objekten intill den begärda noggrannheten. Delsegmentbeskrivningar som redan är kända av avkodaren behöver inte sändas. Brukaren känner exempelvis till delsegment $\{B_{k0}, B_{k1}, B_{k2}, B_{k3}\}$ tillhörande segment k. Delsegmentbeskrivning $\{B_{k5}, B_{k6}, B_{k7}\}$ måste sändas om objekt k efterfrågas intill noggrannhet 7.

EXEMPEL

I detta avsnitt förklaras några exempel på situationer där den föreslagna metoden kan användas.

Antag, enligt figur 5, att det finns i mitten av bilden R51 en region R52 som har formen av en cirkel, vilken måste ha bättre kvalité än området R53 utanför cirkeln som härefter benämnes bakgrunden. Både bakgrunden R53 och regionen R52 skall emellertid överföras samtidigt. Följande äger rum:

1. Originalbilden transformeras med wavelet-transform.

2. En mask i transformdomänen skapas sedan. Denna mask beskriver vilka koefficienter som fordras i transformdomänen för att rekonstruera regionen R52 och bakgrunden R53. Den skapade masken användes sedan för att klassificera koefficienterna i transformdomänen i två segment, en för regionen och en för bakgrunden. De två segmenten bygges upp av ett antal delsegment. Antalet delsegment är i detta exempel det samma som antalet delband i transformdomänen. Den förhandenvarande situationen är alltså:

   2.1 För regionsegmentet tillhörande regionen R52:

   $\{\{r_{0,1}, r_{0,2}, \ldots, r_{0,i}\}, \ldots \{r_{no\_subbands,1}, r_{no\_subbands,2}, \ldots r_{no\_subbands,j}\}\}$
   där i,j är nummer på koefficienterna i de olika delsegmenten.

   2.2 För bakgrundssegmentet tillhörande bakgrunden R53:

   $\{\{b_{0,1}, b_{0,2}, \ldots b_{0,p}\}, \ldots, \{b_{no\_subbands,1}, b_{no\_subbands,2}, \ldots b_{no\_subbands,q}\}\}$
   där p,q är antalet koefficienter i de olika delsegment.

3. De två segmenten kodas sedan enligt följande:

   3.1 För regionsegmentet:

En formbeskrivning S_r och en segmentbeskrivning $T_r=\{B_{r,0}, B_{r,1}, \ldots, B_{r,no\_subbands}\}$ och en uppsättning av delsegmentpekare $\{p\_B_{r,o}, p\_B_{r,1}, \ldots, p\_B_{r,no\_subbands}\}$.

3.2 För bakgrundssegmentet:

En segmentbeskrivning $T_b=\{B_{b,o}, B_{b,1}, \ldots, B_{b,no\_subbands}\}$ och en uppsättning av delsegmentpekare $\{p\_B_{b,0}, p\_B_{b,1}, \ldots, p\_B_{b,no\_subbands}\}$.

4. De två segmenten är sedan sammanförda till en enda bitström, bitströmmen 51, enligt följande:

<image header><TOP><S_r><{$p\_B_{b,0}$, $p\_B_{r,0}$, $p\_B_{b,1}$, $p\_B_{b,no\_subbands}$, $p\_B_{r,no\_subbands}$}><MT(b,r)={$B_{b,0}$, $B_{r,0}$, $B_{b,1}$, $B_{r,1}$, …, $B_{b,no\_subbands}$, $B_{r,no\_subbands}$}>

I detta fall är delsegmenten sammanförda så som visas i övre delen av figur 5 med regionens delbitströmmar 52 tagna omväxlande med bakgrundens delbitströmmar. Observera att i det fall att mottagaren känner till den ordning i vilken de olika delarna av bilden sändes, behövs inte fältet TOP. Den första delen av uppställningen, från <image header> till …p_B…}> är med andra ord en definition av var de olika bildregionerna är placerade i resten av den komprimerade bitströmmen <MT(b,r)={…B…}>.

5. Den sammanförda bitströmmen sändes sedan till mottagaren.

Hos avkodaren inträffar följande:

6. Bildhuvudet tillsammans med topologin, forminformationen och pekarna läses.

7. Avkodaren kan nu skapa samma mask som den ovan angivna.

8. Avkodaren skapar segmenten med de underliggande delsegmenten.

9. Avkodaren börjar med att avkoda den sammanförda bitströmmen och fyller i de överförda transformkoefficienterna i de motsvarande delsegmenten.

10. En invers transform utnyttjas.

11. Bilden sänds och rekonstrueras.

Det ovan angivna är ett sätt att använda den föreslagna metoden. Andra sätt kan vara att sammanföra bitströmmarna på ett annorlunda sätt. Regionen R52 kan exempelvis, enligt nedre delen av figur 5, överföras först, följd av bakgrunden R53. Ett annat exempel kan vara att det finns mer än en region, såsom beskrivits i anslutning till figur 6, varvid de är sammanförda på ett antal olika sätt.

Förutom tidigare nämnda fördelar har den föreslagna metoden också fördelen av att det är möjligt att endast sända forminformationen när detta behövs.

PATENTKRAV

1. Metod vid överförande av en bild (3)mellan en sändare (2,5,6) och en mottagare (7,8), vilken metod omfattar stegen:

- delning av bilden (3) i åtminstone två bildregioner (R1, R2, Rn);

- kodning av bildregionerna (R1,R2,Rn) till en kodad symbolström (21), varvid kodningen utnyttjar en symbolisk representation och har förutbestämda noggrannhetsnivåer i bildregionerna;och

- komprimering av den kodade symbolströmmen till en komprimerad bitström (PS1,27);

k ä n n e t e c k n a d av att metoden omfattar stegen:

- generering (22) av en definition (PS2) av de olika bildregionerna i den komprimerade bitströmmen;

- överförande av nämnda definition (PS2) till mottagaren (7);

- överförande av den komprimerade bitströmmen (PS1,27) till mottagaren (7,8); och

- avkodning (33,34) i mottagaren av förutbestämda delar av den komprimerade bitströmmen (PS1,27) med hjälp av den nämnda definitionen.

2. En anordning för att överföra en bild (3) innefattande:

- en sändare (2,5,6) och en mottagare (7,8);

- medel (4,5) för att dela bilden (3) i minst två bildregioner (R1, R2, Rn);

- en kodningsanordning (5) för att koda bildregionerna (R1,R2,Rn) till en kodad symbolström, vilken kodningsanordning utnyttjar en symbolisk representation och har förutbestämda noggrannhetsnivåer i regionerna;

- en komprimeringsanordning för att komprimera den kodade symbolströmmen till en komprimerad bitström (PS1,27); och

- medel i sändaren (2,5,6) för att sända den nämnda komprimerade bitströmmen (PS1,27) till mottagaren (7,8);

k ä n n e t e c k n a d av att anordningen även omfattar:

- medel (5) för att generera (22) en definition (PS2) av de olika bildregionerna (R1,R2,Rn) i den komprimerade bitströmmen (PS1,27);

- medel i sändaren (2,5,6) för att sända den nämnda definitionen (PS2) till mottagaren (7,8); och

- avkodare (8) i mottagaren för att avkoda (34,35) förutbestämda delar av den komprimerade bitströmmen (PS1,27) med hjälp av den nämnda definitionen (PS2).

SAMMANDRAG

En bild (3), som föreligger i digitaliserad form, skall överföras på en kanal mellan en sändare och en mottagare. Kanalen har begränsad bandbredd och bilden har dels en mindre viktig bakgrund (R1), dels områden av särskild vikt, intresseregioner (R2, Rn). Bilden transformeras till transformkoefficienter och komprimeras (21) och en mask, svarande mot regionerna (R1, R2, Rn), definieras i transformdomänen (22). Transformkoefficienterna klassificeras (23) och hänföres enligt maskdefinitionen till olika segment (SG1,SG2,SGn). Dessa kodas (24) oberoende av varandra till olika grad av exakthet beroende på hur viktig motsvarande region (R1, R2, Rn) i bilden (3) är. Kodningen ger delbitströmmar (25) vilka länkas samman (26) med bildhuvudinformation (271,272) till en bitström (27) som sändes till mottagaren. Denne avkodar bildhuvudet och segmentinformationen samt återskapar masken i transformdomänen, innefattande form och lägen på regionerna (R1, R2, Rn). Bilden återskapas sedan med hjälp därav till önskad noggrannhet i respsektive region. Flera regioner (R2,Rn) med olika grader av bildkvalité kan definieras och endast intressanta delar av bilden behöver avkodas.

Publiceringsfigur: Figur 2

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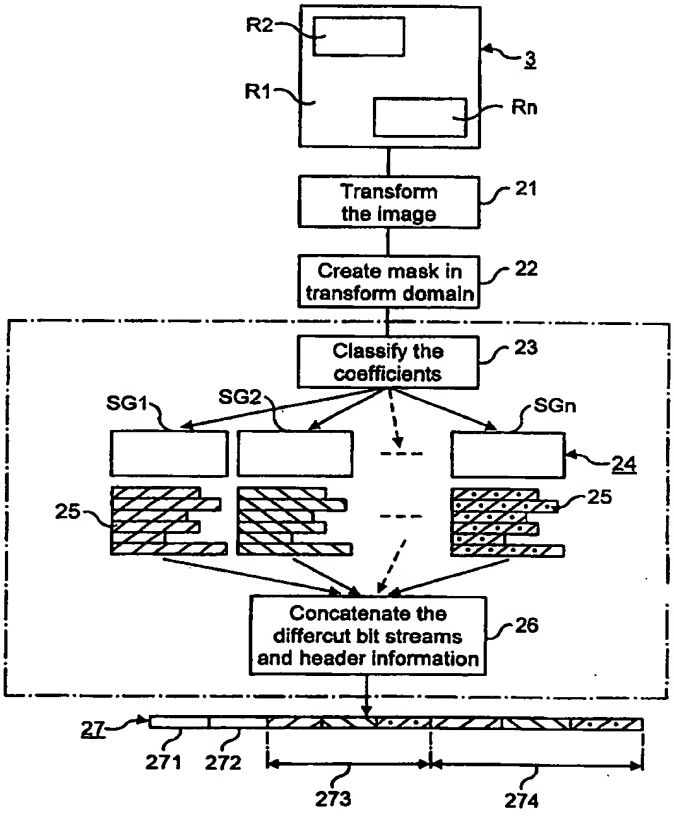
(57) Abstract

An image (3) in digitized form shall be transmitted over a channel between a transmitter and a receiver. The channel has a limited bandwidth and the image has a less important background (R1) and also regions of particular importance, i.e. regions of interest (R2, Rn). The image is transformed into transform coefficients and compressed (21), and a mask corresponding to the regions (R1, R2, Rn) is defined in the transform domain (22). The transform coefficients are classified (23) and assigned to different segments (SG1, SG2, SGn) in accordance with the mask definition. These segments (24) are coded independently of one another to different degrees of accuracy, depending on the importance of corresponding regions (R1, R2, Rn) in the image (3). Coding results in sub–bit streams (25) which are linked together (26) with the image header (271, 272) to form a bit stream (27), which is sent to the receiver. The receiver decodes the image header and the segment information and reconstructs the mask in the transform domain, including shapes and positions of the regions (R1, R2, Rn). The image is then recreated with the aid of the mask to desired degrees of accuracy in respective regions. It is possible to define several regions (R2, Rn) with different degrees of image quality, and only those parts of the image that are of interest need be decoded.



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Method and Apparatus in Transmission of Images.

FIELD OF INVENTION

The present invention relates to a method and to arrangement for coding and extracting regions of interest (ROI) in the transmission of still images and video images. The method and the arrangement are particularly well suited for transform-based coders, such as wavelets and DCT.

DESCRIPTION OF THE BACKGROUND ART

In transmission of digitized still images from a transmitter to a receiver, the image is usually coded in order to reduce the amount of bits required for transmitting the image.

The bit quantity is usually reduced, because the capacity of the channel used is limited. A digitized image, however, consists of a very large number of bits. When transmitting an image that consists of a very large number of bits over a channel which has limited bandwidth, transmission times will be unacceptably long for the majority of applications if it is necessary to transmit every bit of the image.

Consequently, in recent years research has been directed to coding methods and techniques for digitized images with the object of reducing the number of bits necessary to transmit the images.

These methods can be divided into two groups:

Lossless methods, i.e. methods exploiting the redundancy in the image in such manner as to enable the image to be reconstructed by the receiver without loss of information.

Lossy methods, i.e. methods that exploit the fact that not all bits are equally as important to the receiver. Hence, the image received is not identical to the original but looks sufficiently like the original image to the human eye, for instance.

In some applications, certain parts of the transmitted image are of more interest than the remainder of the image, and better visual quality of these parts of the image is therefore desired. Such a part is usually called the region of interest (ROI). Applications in which this can be useful include, for example, medical databases or the transmission of satellite images. In some cases, it is also desired, or necessary, to transmit the region of interest loss-free, while the quality of the remainder of the image is of less importance. There are also occasions when it is required to extract the regions of interest from the bit stream and decode these regions of interest without needing to decode the image as a whole.

Swedish Patent Applications SE 9703690-9 and SE 9800088-8 both describe how a mask can be calculated for delimiting such a region of interest (ROI).

SUMMARY OF THE INVENTION

The present invention addresses the aforesaid problem of defining and transmitting regions of interest and background

regions of mutually different qualities in the transmission of images.

The basic concept of the invention in solving the problem is to transform the image and to define in said transform a mask that corresponds to the regions of interest and to the background regions. The region definition and the image transform are transmitted to a receiver capable of recreating the image with the quality desired in the predetermined regions.

More specifically, the solution involves dividing the image into the desired regions. The image is then transformed to some type of transform coefficients. A mask corresponding to the separate regions in the image is defined in the transform domain and the coefficients classified and assigned to different segments in accordance with the mask definition. The segments thus belong to the corresponding regions in the image. The segments and the coefficients are transmitted in a compressed state to a receiver that is capable of reproducing regions in the image on the one hand and of reproducing the actual image on the other hand with the desired image quality in the various regions.

One advantage afforded by the invention is that several different regions of interest can be defined.

Another advantage is that different regions can have several different degrees of image quality.

Still another advantage is that only those parts of the image that are of vital interest to the user need be decoded, while avoiding decoding of the whole of the image.

Yet another advantage is that the segments can be coded independently of each other.

The invention will now be described in more detail with reference to preferred embodiments thereof and also with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block schematic illustrating an inventive arrangement.

Figure 2 is a flow chart illustrating part of an inventive method.

Figure 3 is a flow chart illustrating a further part of an inventive method.

Figure 4 is a diagram illustrating classification of transform coefficients.

Figure 5 is a diagram for interlinking image segments in a bit stream.

Figure 6 is a view of an image with object.

Figure 7 is a graphic representation of the topology in Figure 6.

DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 is an overview of an arrangement for coding and transmitting images. An image 3 of an object is stored in digital form in a digital camera 1, and the image presented on a screen 4. The screen is connected to a computer 2 which is programmed to divide the image 3 into objects or regions, of which a background region R1 and regions of interest R1 and Rn are shown. An image coder 5 in the computer 2 wavelet-transforms the image, while simultaneously compressing the image, and generates a compressed bit stream PS1. An operator at the image screen 4 defines the regions of interest R2 and Rn. The image coder includes means for creating a mask PS2 in accordance with the regions and defines separate parts, segments, of the bit streams with respect to the corresponding regions R1, R2 and Rn, with the aid of said mask. The definition also enables the regions R1, R2, Rn in the form of said separate segments in the bit stream PS1 to be coded to different degrees of accuracy. A transmitter 6 sends the bit stream, including the definition of the positions and shapes of the regions R2 and Rn to a receiver 7 which is connected to a computer that includes an image decoder 8. The decoder decodes the bit stream PS1 and reproduces the mask definition PS2 and presents the image on an image display screen 9. The accuracy of the background R1 is relatively poor, whereas each of the regions R2 and Rn has respectively a higher degree of accuracy.

The following definitions are given in order to assist in describing the inventive method:

- A segment is defined here as all of the coefficients in the transform domain that belong to a given object or the background in the image. The segment can then be divided further into subsets.

- A subset is defined here as a number of coefficients in a part of the transform domain (e.g. a subband in the case of the wavelet transform) which is required for the reconstruction and which belongs to a segment in the digitized image, see Figure 4.

As before mentioned, the coefficients are classified and can be assigned to individual segments. When this classification is made, the segments are coded independently of one another to different levels of accuracy, which yields a bit stream for each segment. These segments are then joined together.

The inventive encoding method will be described with reference to Figure 2. The digitized image 3 to be transmitted presents the background R1 and the regions of interest R2 and Rn. The following procedural steps are carried out:

1. Perform a transformation of the image 3 according to step 21. In the illustrated case, this transformation is performed with a wavelet transform or with a discrete cosine transform (DCT).

2. Create a mask according to step 2 with the aid of information as to how the digitized image 3 shall be divided into the background R1 and the objects R2 and Rn. The techniques described in Swedish Patent Applications SE

9703690-9 and SE 9800088-8 can be used to this end. The mask is created in the transform domain and describes which coefficients are required to reconstruct the different objects or the background. Different segments SG1, SG2 and SGn correspond to the background R1 and the objects R2 and Rn.

3. Use the mask to classify the transform coefficients as belonging to the different segments SG1, SG2, SGn, according to step 3.

4. Code the segments independently of one another, according to step 24. This gives the number of bits needed for each subset.

5. Concatenate the subset streams together with necessary substream information and header information, according to step 26. This requires a bit stream description, given below.

6. Send the concatenated bit streams 27. This includes shape data 271, bit stream information 272, subband 0 referenced 273 and subband 1 referenced 274.

The method enables the receiver to have immediate access to any parts of the image when so desired, as shown in Figure 3. This is possible because the information as to where different parts are found in the bit stream is known.

One method of how the decoder may work is described below with reference to Figure 3.

1. Receive the bit stream 27 and decode the header information required, according to step 31.

2. Find and decode the required segment information, step 32.

3. Create a mask in the transform domain, for instance with the aid of the technique described in said Patent Applications SE 9703690-9 and SE 9800088-8; step 33. The mask describes those coefficients that are required to reconstruct the desired objects or background.

4. Decode requisite segment data from the bit stream; step 34.

5. Reconstruct the requisite segments; step 35.

6. Decode and show the image; step 36.

BIT STREAM DESCRIPTION

A description will now be given of those components in the bit stream 27 that are required when applying the described technique.

Data structures and pointers

Pointer

A pointer is a set of symbols that defines the position of a bit or a byte in a bit stream or a file. Many ways of defining a pointer have been defined in computer science. Any

one of these methods can be used here. A pointer can be defined implicitly by a specific bit stream composition rule. A pointer can be defined relative to an explicitly or implicitly determined position. A simple way of defining a pointer is to determine the number of bits between the requested position and a known reference point, such as the first bit in the bit stream, for instance.

Topology descriptor

The topology descriptor, TOP, is a set of symbols that defines the topological relationship between numbered objects and shapes. This is illustrated in Figure 6, in which four objects 01, 02, 03, 04 and four shapes S1, S2, S3 and S4 are shown. The topology of the image can be represented, e.g., as a tree graph as shown in Figure 7. The nodes and the edges of the tree graph can be coded in a data structure using well known methods. P_TOP is a pointer to a topology descriptor.

Shape descriptor

A shape descriptor, S_i, defines the appearance of a closed boundary line of an object. The shape number, *i*, is given by a topology descriptor. Many different shape coding techniques can be used. Examples of such methods are chain coding and shape coding methods in MPEG-4. Shape descriptors can be decoded independently of one another once their respective positions in the bit stream is known. P_S_i is a pointer to a shape descriptor.

Segment descriptor

A segment descriptor, T_i, is a compressed set of symbols that encode a segment as described above. The segment includes an ordered set of subsets. The object number, i, is given by a topology descriptor. p_T_i is a pointer to a segment descriptor.

Subset descriptor

A subset descriptor, B_{ij}, is an independently decodable subset, j, of a segment descriptor, T_i, which describes, e.g., the coefficients that belong to a given subband, j, as described above. p_B_{ij} is a pointer to a subset descriptor.

Multiplexed segment descriptor

Several segment descriptors, $\{T_i, T_j, T_k \ldots\}$, can be multiplexed into a common data structure MT(i,j,k). This is done normally for the purpose of simultaneous progressive transmission of a set of objects. The data structure, MT, is called a multiplexed segment descriptor. Several multiplexing methods can be used. p_MT is a pointer to a multiplexed segment descriptor.

Segment multiplexing methods

Examples of multiplexing methods are shown in Figure 5. A simple method is to interleave subsets 52 belonging to the component segments so that:

$$MT(i,j,k)=\{B_{i0}, B_{j0}, B_{k0}, B_{i1}, B_{j1}, B_{k1}, B_{i2}, B_{j2}, B_{k2}\ldots\}$$

In this case, the order of the symbols corresponds to the order in the bit stream 51, with symbols on the left being sent first. Subsets in a multiplexed stream may be excluded if they are known by the decoder.

Bit stream storage format

In order to obtain immediate access to any object whatsoever in the image, the stored bit stream or file structure should preferably include at least the following components:

In the image header, if required:

Topology descriptor TOP

Pointers to shape descriptors $\{p\_S_1, p\_S_2 \ldots p\_S_N\}$

Pointers to segment descriptors $\{p\_T_0, p\_T_1, \ldots p\_T_N\}$

Optional pointers to subset descriptors: for each $k=[0,N]$, $\{p\_B_{k0}, p\_B_{k1}, \ldots p\_B_{kN}\}$

In the actual stored bit stream if needed:

Shape descriptors $\{S_1, S_2, \ldots S_N\}$

Segment descriptors $\{T_0, T_1, \ldots T_N\}$

A group of segment descriptors with index {k,l,m...} can optionally be replaced with a multiplexed segment descriptor MT(k,l,m...)

N is the number of stored objects. The background is the object with index 0.

PROGRESSIVE TRANSMISSION WITH IMMEDIATE ACCESS TO OPTIONAL OBJECTS

A server receives a request for sending image data to a client. The image is stored with the server in the format described in the preceding passage. Part of the stored data structures (topological data, shapes, segments and subsets) may have already been sent to the receiving terminal. This section of the description describes a procedure for composing a bit stream with the server that handles the request.

Example

Request from user

A simple request contains the following information:

Send objects with numbers k, l, m ... with a respective accuracy of n_k, n_l, n_m where the accuracy is the index for the highest subset that is sent for each index.

Several primitive requests may be sent. They will be served in the order in which they are received or in an otherwise specified order.

Procedure for serving a request (details)

Send topological information if needed. TOP is sent in response to a first request for image information.

Send all shape descriptors that are necessary to describe the boundaries of the objects requested. It is not necessary to send shape descriptors that are already known to the decoder. When using the topological tree structure in Figure 7, it is found that not all shape descriptors on the same branch as the object or on the same or lower hierarchical level need be sent. The server knows the state of the decoder and will send solely those shape descriptors that are unknown to the decoder.

Send (multiplexed) subset descriptors that describe the objects requested to the defined accuracy. Subset descriptors that are already known to the decoder need not be sent. For instance, the user is aware of the subsets $\{B_{k0}, B_{k1}, B_{k2}, B_{k3}\}$ belonging to segment k. Subset descriptors $\{B_{k5}, B_{k6}, B_{k7}\}$ must be sent when object k is requested to accuracy 7.

EXAMPLES

In this section of the description, examples are given with respect to situations in which the proposed method can be applied.

Assume, according to Figure 5, that in the centre of the image R51 there is an encircled region R52 whose quality must be better than the quality of the region R53 outside the circle, this latter region being referred to hereinafter as

the background. However, both the background R53 and the region R52 shall be transmitted simultaneously. The following then takes place:

1. The original image is transformed with a wavelet transform.

2. A mask is then created in the transform domain. This mask describes the coefficients that are required in the transform domain in order to reconstruct the region R52 and the background R53. The created mask is then used to classify the coefficients in the transform domain in two segments, one segment for the region and one segment for the background. The two segments are built up by a number of subsets. In the illustrated case, the number of subsets is the same as the number of subbands in the transform domain. The situation on hand is thus:

2.1 In respect of the region segment belonging to the region R52:

$\{\{r_{0,1}, r_{0,2}, \ldots, r_{0,1}\}, \ldots \{r_{no\_subbands,1}, r_{no\_subbands,2}, \ldots r_{no\_subbands,j}\}\}$
where i,j are the number of coefficients in the different subsets.

2.2 In respect of the background segment belonging to the background R53:

$\{\{b_{0,1}, b_{0,2}, \ldots b_{0,p}\}, \ldots, \{b_{no\_subbands,1}, b_{no\_subbands,2}, \ldots b_{no\_subbands,q}\}\}$
where p,q are the number of coefficients in the different subsets.

3. The two subsets are then coded as follows:

3.1 In respect of the region segment:

A shape descriptor $T_r=\{B_{r,0}, B_{r,1}, \ldots, B_{r,no\_subbands}\}$ and a set of subset pointers $\{p\_B_{r,o}, p\_B_{r,1}, \ldots, p\_B_{r,no\_subbands}\}$.

3.2 In respect of the background segment:

A segment descriptor $T_b=\{B_{b,0}, B_{b,1}, \ldots, B_{b,no\_subbands}\}$ and a set of subset pointers $\{p\_B_{b,0}, B_{b,1}, \ldots, p\_B_{b,no\_subbands}\}$.

4. The two segments are then combined into a single bit stream, bit stream 51, in the following manner:

<image header><TOP><S_r><{$p\_B_{b,0}$, $p\_B_{r,0}$, $p\_B_{b,1}$, $p\_B_{b,no\_subbands}$, $p\_B_{r,no\_subbands}$}><MT(b,r)={$B_{b,0}$, $B_{r,0}$, $B_{b,1}$, $B_{r,1}$, ..., $B_{b,no\_subbands}$, $B_{r,no\_subbands}$}>

In this case, the subsets are combined in the manner shown in the upper part of Figure 5, with the sub-bit streams 52 of the region being taken alternately with the sub-bit streams of the background. It will be noted that the TOP field is not required when the receiver is aware of the order in which the various parts of the image are set. The first part of the array, from <image header> to ...p_B...}> is, in other words, a definition of where the different image regions are placed in the remainder of the compressed bit stream <MT(b,r)={...B...}>.

5. The combined bit stream is then sent to the receiver.

The following takes place on the decoder side:

6. The image header together with the topology, shape information and pointers are read.

7. The decoder is now able to create the same mask as that described above.

8. The decoder creates the segments with the underlying subsets.

9. The decoder commences with decoding the combined bit stream and filling in the transmitted transform coefficients in the corresponding subsets.

10. An inverse transform is used.

11. The image is transmitted and reconstructed.

The aforedescribed is one way of using the proposed method. Other methods may be to combine (mix) the bit streams in another way. For instance, as shown in the bottom part of Figure 5, the region R52 may be transmitted first, followed by the background R53. Another example is one in which more than one region is found, as described with reference to Figure 6, wherewith these regions are combined in a number of different ways.

In addition to the earlier mentioned advantages, the proposed method has the added advantage of enabling shape information to be sent only when needed.

CLAIMS

1. A method of transmitting an image (3) between a transmitter (2, 5, 6) and a receiver (7, 8), comprising the steps of:

- dividing the image (3) into at least two image regions (R1, R2, Rn);
- coding the image regions (R1, R2, Rn) into a coded symbol stream (21), said coding utilising a symbolic representation and having predetermined accuracy levels in said image regions; and
- compressing the coded symbol stream into a compressed bit stream (PS1, 27),

characterised in that the method includes the further steps of:

- generating (22) a definition (PS2) of the different image regions in the compressed bit stream;
- transmitting said definition (PS2) to the receiver (7);
- transmitting the compressed bit stream (PS1, 27) to the receiver (7, 8; and
- decoding (33, 34) in the receiver predetermined parts of the compressed bit stream (PS1, 27) with the aid of said definition.

2. An arrangement for transmitting an image (3), comprising:

- a transmitter (2, 5, 6) and a receiver (7, 8);
- means (4, 5) for dividing the image (3) into at least two image regions (R1, R2, Rn);
- a coding device (5) for coding the image regions (R1, R2, Rn) into a coded symbol stream, said coding device

utilising a symbolic representation and having predetermined accuracy levels in said regions;

- a compressing device for compressing the coded symbol stream into a compressed bit stream (PS1, 27); and
- means in the transmitter (2, 5, 6) for transmitting said compressed bit stream (PS1, 27) to the receiver (7, 8),

characterised in that the arrangement also includes:

- means (5) for generating (22) a definition (PS2) of the different image regions (R1, R2, Rn) in the compressed bit stream (PS1, 27);
- means in the transmitter (2, 5, 6) for transmitting said definition (PS2) to the receiver (7, 8); and
- a decoder (8) in the receiver for decoding (34, 35) predetermined parts of the compressed bit stream (PS1, 27) with the aid of said definition (PS2).

AMENDED CLAIMS

[received by the International Bureau on 9 November 1999 (09.11.99) ;
original claims 1-2 replaced by amended claims 1-18 (5pages)]

1. A method of transmitting an image (3) between a transmitter (2, 5, 6) and a receiver (7, 8), comprising the steps of:

- dividing the image (3) into at least two image regions (R1, R2, Rn);
- coding the image regions (R1, R2, Rn) into a coded symbol stream (21), said coding utilising a symbolic representation and having predetermined accuracy levels in said image regions; and
- compressing the coded symbol stream into a compressed bit stream (PS1, 27),

characterised in that the method includes the further steps of:

- generating (22) a definition (PS2) of an outer boundary line (S_i) of at least one of the image regions (R2,Rn);
- transmitting said definition (PS2) to the receiver (7);
- transmitting the compressed bit stream (PS1, 27) to the receiver (7, 8; and
- decoding (33, 34) in the receiver with the aid of said definition.

2. The method of claim 1, **characterised** in that two different of the image regions (R2,Rn) are coded to have said predetermined accuracy levels independently of each other.

3. A method of transmitting an image (3) between a transmitter (2, 5, 6) and a receiver (7, 8), comprising the steps of:

- dividing the image (3) into at least two image regions (R1, R2, Rn);
- coding the image regions (R1, R2, Rn) into a coded symbol stream (21), said coding utilising a symbolic representation and having predetermined accuracy levels in said image regions; and

- compressing the coded symbol stream into a compressed bit stream (PS1, 27),

characterised in that the method includes the further steps of:

- generating (22) a definition (PS2) of a mask (PS2) for at least one of the image regions (R2,Rn), two different of the image regions (R2,Rn) being encoded to have said predetermined accuracy levels independently of each other;
- transmitting said definition (PS2) to the receiver (7);
- transmitting the compressed bit stream (PS1, 27) to the receiver (7, 8; and
- decoding (33, 34) in the receiver with the aid of said definition.

4. The method of claim 1,2 or 3, **characterised** in that only predetermined parts of the compressed bit stream (PS1,27) are decoded.

5. The method of any of the claims 1, 2, 3 or 4, **characterised** by generating a topology description, defining the topological relationship between objects (O1, O2, O3, O4) and shapes (S1, S2, S3, S4) in the image.

6. The method of any of the claims 1, 2, 3 or 4, **characterised** by generating a shape description, defining the appearance of the closed boundary line (S_i) of an object (O1, O2, O3, O4) in the image.

7. The method of any of the claims 1, 2, 3 or 4, **characterised** by generating a segment description, defining which transform coefficients that belong to respective segment.

8. The method of claim 7, **characterised** by generating a subset description, defining which transform coefficients that belong to an independently decodable part of a segment.

9. The method of any of the claims 5, 6, 7 or 8, **characterised** by generating of a pointer, defining a position in the bit stream (27) for the respective one of the above mentioned descriptions.

10. An arrangement for transmitting an image (3), comprising:

- a transmitter (2, 5, 6) and a receiver (7, 8);
- means (4, 5) for dividing the image (3) into at least two image regions (R1, R2, Rn);
- a coding device (5) for coding the image regions (R1, R2, Rn) into a coded symbol stream, said coding device utilising a symbolic representation and having predetermined accuracy levels in said regions;
- a compressing device for compressing the coded symbol stream into a compressed bit stream (PS1, 27); and
- means in the transmitter (2, 5, 6) for transmitting said compressed bit stream (PS1, 27) to the receiver (7, 8),

characterised in that the arrangement also includes:

- means (5) for generating (22) a definition (PS2) of an outer boundary line (S_i) of at least one of the image regions (R2,Rn);
- means in the transmitter (2, 5, 6) for transmitting said definition (PS2) to the receiver (7, 8); and
- a decoder (8) in the receiver for decoding (34, 35) of the compressed bit stream (PS1, 27) with the aid of said definition (PS2).

11. The arrangement of claim 10, **characterised** in that the coding device is arranged to encode (24) two different of the image regions (R2, Rn) to have the predetermined accurracy levels independently of each other.

12. An arrangement for transmitting an image (3), comprising:

- a transmitter (2, 5, 6) and a receiver (7, 8);
- means (4, 5) for dividing the image (3) into at least two image regions (R1, R2, Rn);
- a coding device (5) for coding the image regions (R1, R2, Rn) into a coded symbol stream, said coding device utilising a symbolic representation and having predetermined accuracy levels in said regions;
- a compressing device for compressing the coded symbol stream into a compressed bit stream (PS1, 27); and
- means in the transmitter (2, 5, 6) for transmitting said compressed bit stream (PS1, 27) to the receiver (7, 8),

characterised in that the arrangement also includes:

- means (5) for generating (22) a definition (PS2) of a mask (PS2) for at least one of the image regions (R2,Rn), the coding device (5) being arranged to encode (24) two different of the image regions (R2,Rn) to have said predetermined accuracy levels independently of each other;
- means in the transmitter (2, 5, 6) for transmitting said definition (PS2) to the receiver (7, 8); and
- a decoder (8) in the receiver for decoding (34, 35) of the compressed bit stream (PS1, 27) with the aid of said definition (PS2).

13. The arrangement of claim 10, 11 or 12, **characterised** in that the decoder (8) is arranged to decode only predetermined parts of the compressed bit stream (PS1,27).

14. The arrangement of claim 10, 11, 12 or 13, **characterised** in that the transmitter (2, 5, 6) has means for generating a topology description, defining the topological relationship between objects (O1, O2, O3, O4) and shapes (S1, S2, S3, S4) in the image.

15. The arrangement of claim 10, 11, 12 or 13, **characterised** in that the transmitter (2, 5, 6) has means for generating a shape description, defining the appearance of the closed boundary line (S_i) of an object (O1, O2, O3, O4) in the image.

16. The arrangement of claim 10, 11, 12 or 13, **characterised** in that the transmitter (2, 5, 6) has means for generating a segment description, defining which transform coefficients that belong to respective segment.

17. The arrangement of claim 16, **characterised** in that the transmitter (2, 5, 6) has means for generating a subset description, defining which transform coefficients that belong to an independently decodable part of a segment.

18. The arrangement of claim 14, 15, 16 or 17, **characterised** in that the transmitter (2, 5, 6) has means for generating a pointer, defining a position in the bit stream (27) for the respective one of the above mentioned descriptions.

STATEMENT UNDER ARTICLE 19

In the amended independent method claim 1, which in the main corresponds to earlier claim 1, a feature defining an outer boundary line is inserted. This is supported by the description page 9, lines 22,23. Dependent claim 2 defines that different regions are coded independently, supported by the description page 7, lines 12-14. The new independent method claim 3, also in the main corresponding to earlier claim 1, defines a mask for the image regions and that the image regions are coded independently of each other. Support in the description is to be found at page 3, lines 14-19; page 6, line 29 to page7, line 10; page 7, lines 12-14.

The scope of earlier claim 1 has been broadend in one respect. The feature of decoding predetermined parts of the bit stream has been removed from claim 1 and is instead defined in the new dependent claim 4.

The new independent method claims 5-9 define a number of descriptions and an associated pointer for the transmitted image. Support is in the description at page 8, line 20 to page 10, line 14.

The earlier independent device claim 2 is amended in a corresponding way as claim 1 and is now claim 10. The new device claim 12 corresponds to the new method claim 3. The new independent device claims 11 and 13-18 correspond to the respective claims 2 and 4-9.

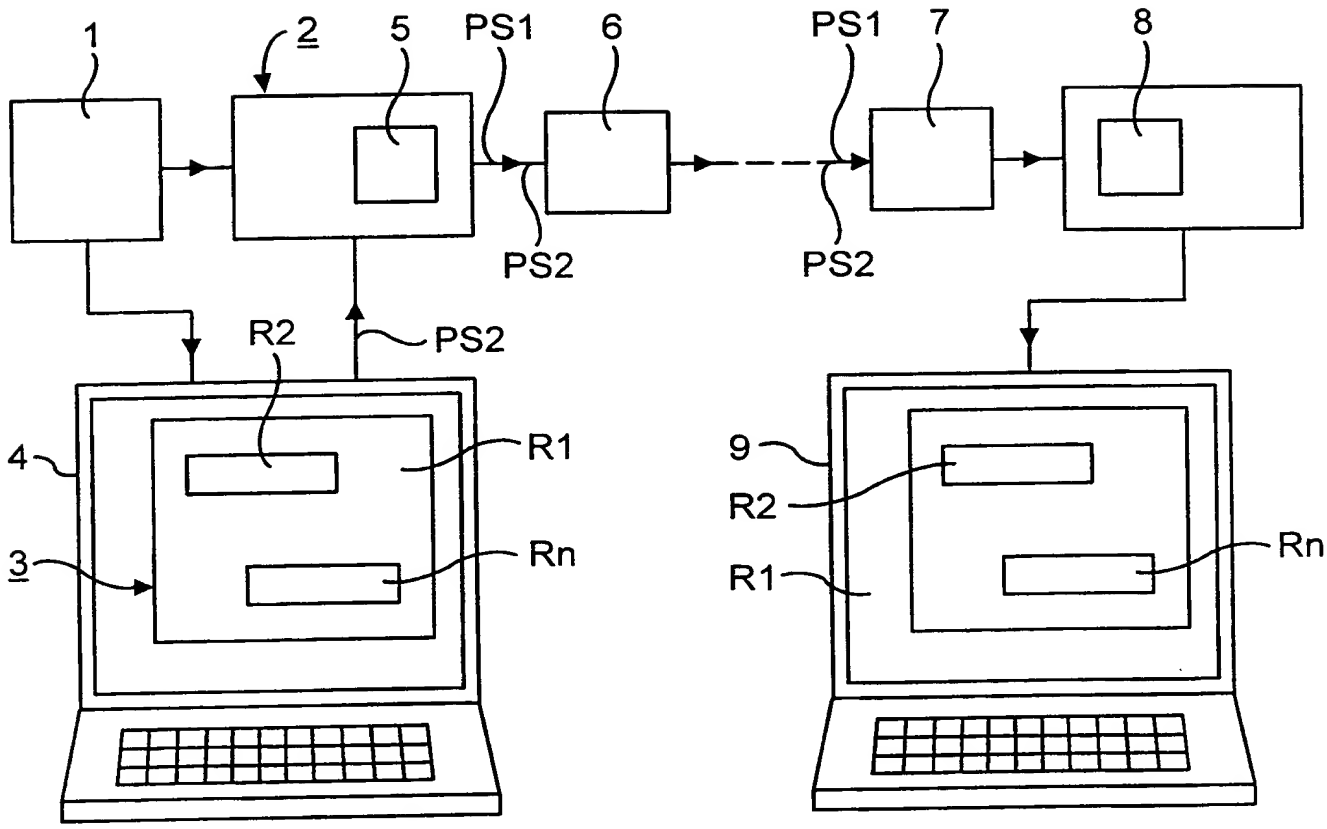

Fig. 1

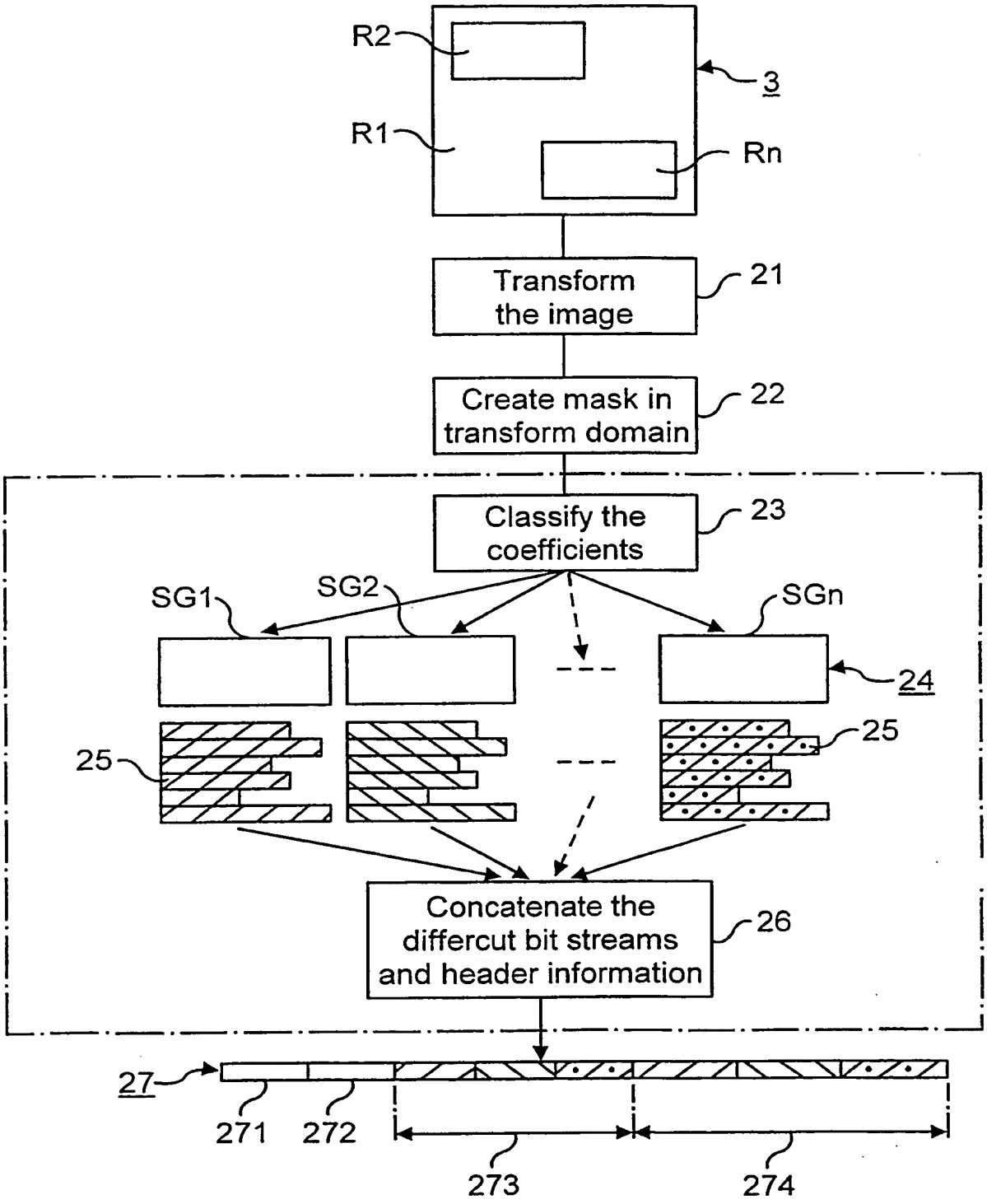
R2
3
R1
Rn
Transform the image
21
Create mask in transform domain
22
Classify the coefficients
23
SG1
SG2
SGn
24
25
25
Concatenate the differcut bit streams and header information
26
27
271
272
273
274

Fig. 2

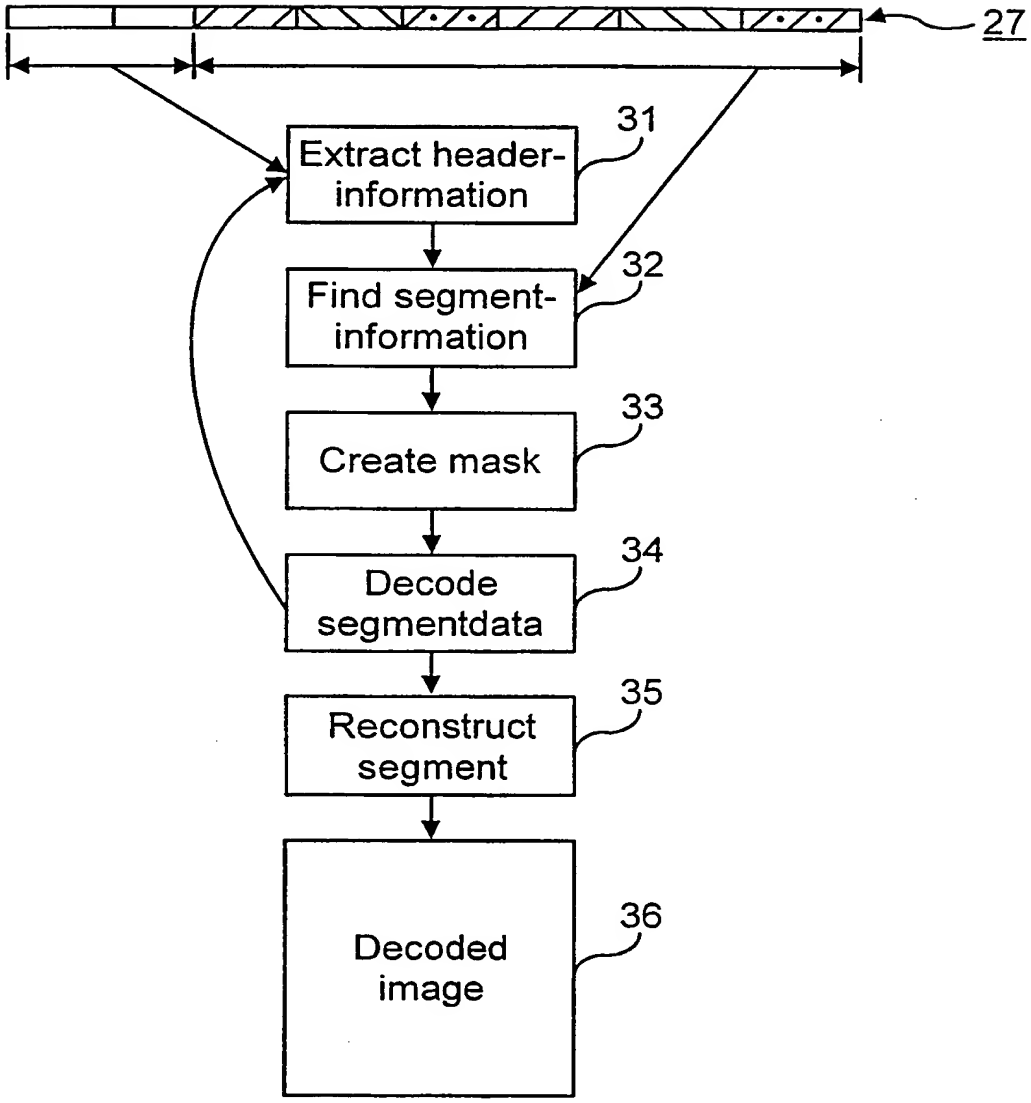
27
Extract header-information
31
Find segment-information
32
Create mask
33
Decode segmentdata
34
Reconstruct segment
35
Decoded image
36

Fig. 3

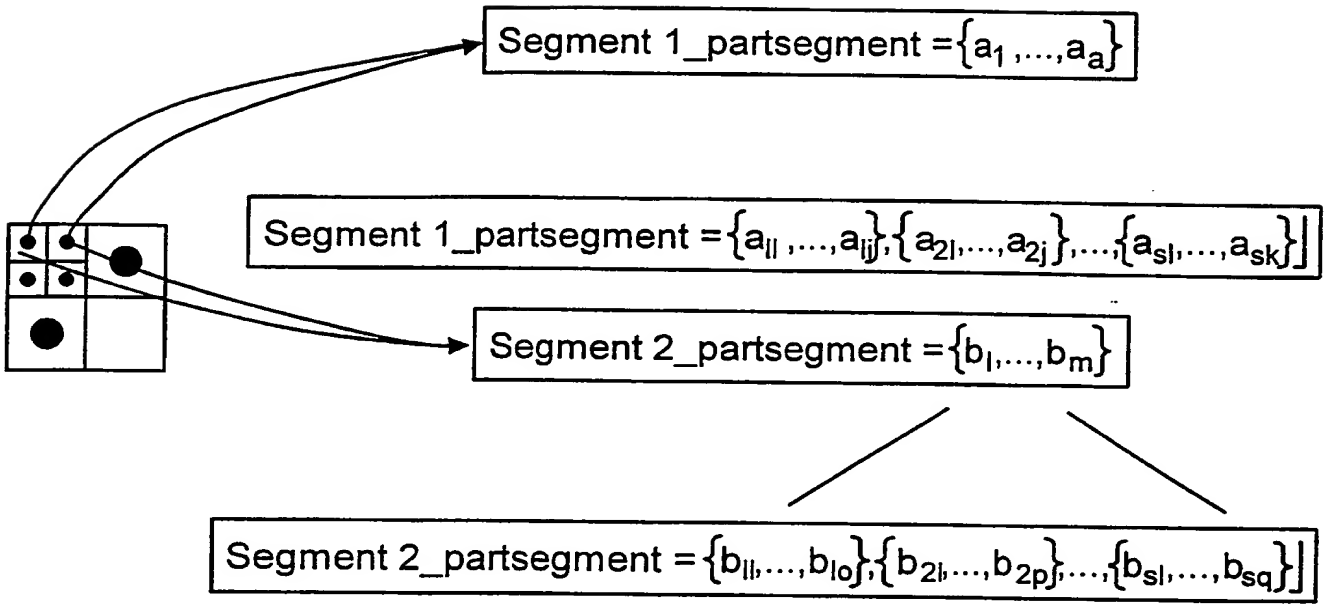
Segment 1_partsegment = {a1,...,aa}
Segment 1_partsegment = {a11,...,a1j},{a21,...,a2j},...,{as1,...,ask}
Segment 2_partsegment = {b1,...,bm}
Segment 2_partsegment = {b11,...,b1o},{b21,...,b2p},...,{bs1,...,bsq}

Fig. 4

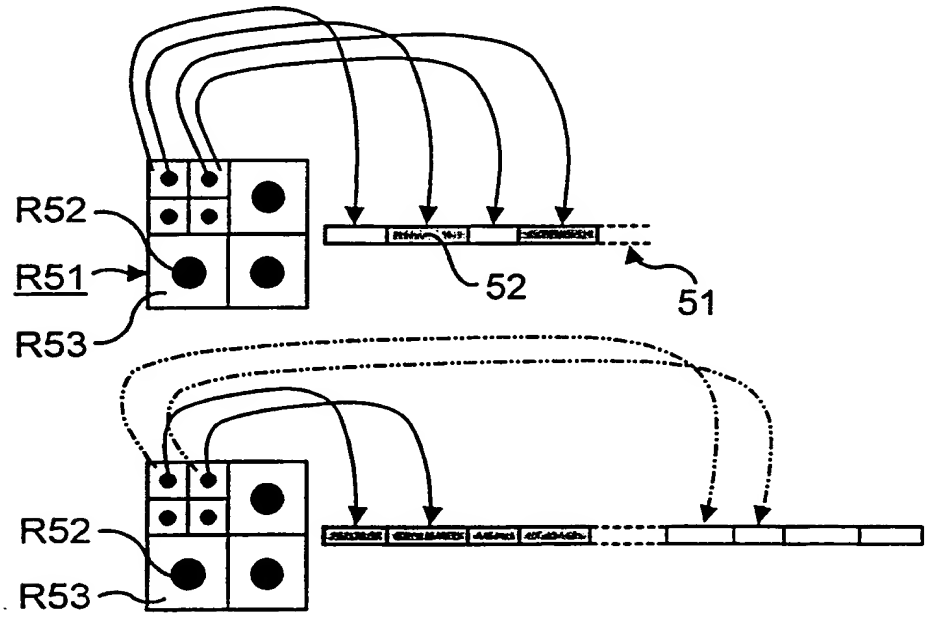
R52
R51
R53
52
51
R52
R53

Fig. 5

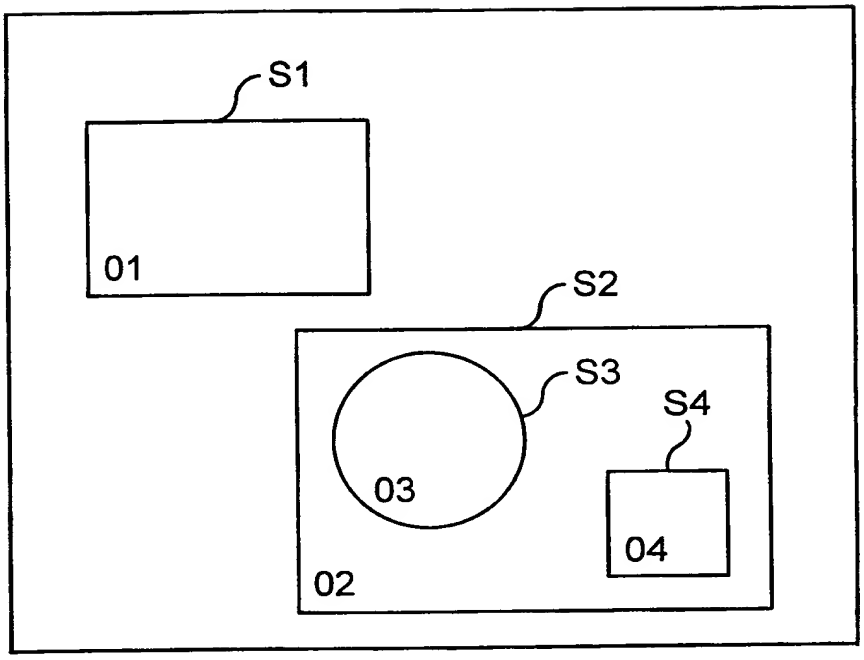

Fig. 6

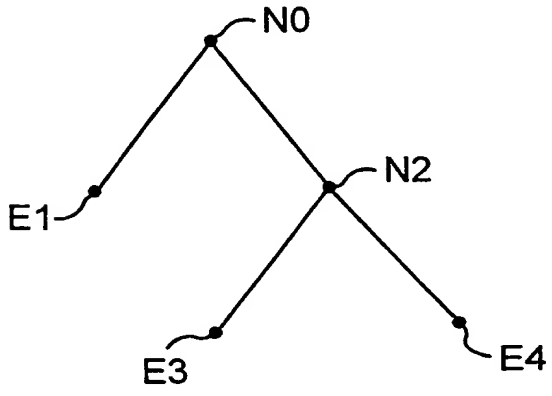

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/01024

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04N 7/26, G06T 9/00
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04N, G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5757974 A (J.M. IMPAGLIAZZO ET AL), 26 May 1998 (26.05.98), column 6, line 20 - column 7, line 8	1-2
A	Visula Communications and Image Processing'98 Proceedings of the SPIE, Volume 3309, p. 674-685 January 1998, A. Signoroni et al, "Progressive ROI Coding and Diagnostic Quality for Medical Image Compression"	1-2

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 Sept 1999	16 -10- 1999
Name and mailing address of the ISA: Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Michel Gascoin/cs Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/08/99

International application No.
PCT/SE 99/01024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5757974 A	26/05/98	NONE	

CLAIMS

1. A method of transmitting an image (3) between a transmitter (2, 5, 6) and a receiver (7, 8), comprising the steps of:

- dividing the image (3) into at least two image regions (R1, R2, Rn);
- coding the image regions (R1, R2, Rn) into a coded symbol stream (21), said coding utilising a symbolic representation and having predetermined accuracy levels in said image regions; and
- compressing the coded symbol stream into a compressed bit stream (PS1, 27),

characterised in that the method includes the further steps of:

- generating (22) a definition (PS2) of the different image regions in the compressed bit stream;
- transmitting said definition (PS2) to the receiver (7);
- transmitting the compressed bit stream (PS1, 27) to the receiver (7, 8; and
- decoding (33, 34) in the receiver predetermined parts of the compressed bit stream (PS1, 27) with the aid of said definition.

2. An arrangement for transmitting an image (3), comprising:

- a transmitter (2, 5, 6) and a receiver (7, 8);
- means (4, 5) for dividing the image (3) into at least two image regions (R1, R2, Rn);
- a coding device (5) for coding the image regions (R1, R2, Rn) into a coded symbol stream, said coding device

utilising a symbolic representation and having predetermined accuracy levels in said regions;

- a compressing device for compressing the coded symbol stream into a compressed bit stream (PS1, 27); and
- means in the transmitter (2, 5, 6) for transmitting said compressed bit stream (PS1, 27) to the receiver (7, 8),

characterised in that the arrangement also includes:

- means (5) for generating (22) a definition (PS2) of the different image regions (R1, R2, Rn) in the compressed bit stream (PS1, 27);
- means in the transmitter (2, 5, 6) for transmitting said definition (PS2) to the receiver (7, 8); and
- a decoder (8) in the receiver for decoding (34, 35) predetermined parts of the compressed bit stream (PS1, 27) with the aid of said definition (PS2).